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MEMORANDUM DRAFT

SUBJECT: Implications of St. Louis Tunnel Treatment Pond Failures

FROM: Dan Wall, EPA Toxicologist

TO: Steven Way, EPA On-Scene Coordinator

The St. Louis Tunnel (SLT) Passive Treatment system sits adjacent to the Delores River. The treatment system is a series of ponds that are designed to precipitate metals emanating from SLT drainage and as a consequence the sediments from the treatment ponds have become highly contaminated with a variety of metals. Sediment core samples were collected from Ponds 5, 9, 11, and 18, and analyses of these core samples and of sediment samples collected in 2000 and 2003 reveal a roughly uniform composition of metals throughout the pond sludges at depth. The sediments all contain concentrations of Zinc ranging from 18,000 - 37,700 ppm, Cadmium ranging from 51.4 to 190 ppm, Copper ranging from 650 to 2460 ppm, and Lead ranging from 200 ppm to 957 ppm **(Citation)**. This memo is intended to discuss the ecological implications of a treatment pond(s) failing to contain the sediments and releasing them to the Delores River.

The assessment of the potential toxicity of sediments based on bulk metals concentrations is an imprecise endeavor without additional supporting information. The best available approach for this type of comparison is to compare benchmarks developed in the consensus-based sediment quality guidelines for freshwater ecosystems document (MacDonald et al, 2000) to sediment concentrations. The benchmarks developed in this document include a Threshold Effect Concentration (TEC) and Probable Effect Concentration (PEC). Concentrations below the TEC are considered to be protective of aquatic invertebrate and have been shown to be accurate in at least 72% of the metals contaminated sediments tested. Concentrations above the PEC are considered likely to harm organisms and have been shown to accurately predict toxicity in at least 75% of the tested sediments.

As can be seen in the following table the concentrations of contaminants in the sediments greatly exceed the higher PEC benchmark value with cadmium and zinc exceeding PEC values by up to 2 orders of magnitude. Despite the difficulties associated with assessing the potential toxicity of sediments it is almost a certainty that if treatment pond sediments were released to the Delores River in sufficient quantity they would be toxic to aquatic invertebrates.

Metal	TEC (ppm)	PEC (ppm)	Sediment Concentration Range (ppm)
Cadmium	1	5	51.4 - 190
Copper	32	149	650 - 2460
Lead	36	128	200 - 957
Zinc	121	459	18,000 – 37,700

The effects would likely run a continuum of severe impacts near the site to minor impacts at some downstream location. The footprint of sediment deposition would be the most severely impacted based on both the physical and chemical effects on the stream bed. Areas inundated with contaminated sediments would eliminate virtually all benthic invertebrate habitat by filling in spaces in the cobble that are needed by most resident insects to survive and by fish to reproduce. Immediate chemical impacts to downstream aquatic populations would likely be observed as a pulse of high metals concentrations released with and from the tailings. Fish kills would be probable. For some extended period of time after the failure, metals from the released sediments would be leached into the stream and would likely produce localized areas of lethal concentrations of metals. Gradually the leachable metals would be depleted and areas that weren't inundated with sediments would begin to recover.

MacDonald, D.D., C.G. Ingersoll, and T.A. Berger. 2000. Development and evaluation of consensus-based sediment quality guidelines for freshwater ecosystems. Arch. Environ. Contam. Toxicol. 39:20-31.